

Physics in Mozambique: the next “Big Thing”

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The challenges of conducting basic research in Physics in developing nations are many and may be reflected by the lack of participation in relevant networks and big physics experimental centers around the globe. Although the base of Mozambican economy is agriculture, the country has, in recent years, seen substantial foreign investments in the mining industry, especially in Coal, Heavy Sands, and Liquefied Natural Gas (LNG). This has raised awareness for the need to develop local and basic knowledge on technology in order to more effectively harbor complex industrial companies.

The cooperation between the USA and Mozambique dates decades back and includes cooperation in areas such as health (e. g. Bill & Melinda Gates Foundation), democracy, education and culture represented by the American Cultural Center-Martin Luther King in Maputo. Mozambique is also the land of birth of Teresa Heinz Kerry, the wife of the 68th United States Secretary. Her father in Mozambique pioneered the applications of Atomic Physics in medicine in the emerging field of diagnostic radiology back then in the last century, when the foundations of modern physics were still in the making.

Accelerator technology: The first experience with a particle accelerator in Mozambique was in the late sixties, when a 500 keV Van de Graaff proton accelerator was commissioned [1] and functioned normally until independence (1975), when most of the experts in Nuclear Physics fled the country due to political reasons. Likewise, a Co-60 machine for radiation therapy (RT) worked until 1975 and has recently been decommissioned by the International Atomic Energy Agency (IAEA). After a long period of stagnation, the Van de Graaff generator was reconditioned at the Eduardo Mondlane University (UEM), Mozambique, in the late nineties in collaboration with researchers from Sweden [1]. The generator was intended for multidisciplinary research in ion beam analysis (IBA) with focus on particle induced X-ray emission (PIXE), Rutherford Backscattering (RBS) and nuclear reaction analysis (NRA) [1]. With the advent of increasing incidences of cancer malignancies curable with RT [2] clinical linear (electron) accelerators (LINACs) were introduced with potential to be used both for research and cure of cancer patients.

Radiation Therapy: Most common cancers in Mozambique are prostate, cervical and skin cancer [2] and RT is one of the main treatment modalities for cure of these malignancies. To comply with international rules on the use of accelerator technology in education, industry, and medicine, Mozambique became a member state to the IAEA in 2006 [2, 3]. In the same year, a local population based cancer registry was established in

the city of Beira [2]. A radiation safety authority (ANEA) [4, 5] was established in 2009 [4] and a nuclear bill was passed by parliament [6]. With RT, most patients will be treated locally; especially those who cannot afford to receive RT abroad. On par with the required technology and infrastructure, education and training in nuclear technology including electronics and medical physics is one of the biggest challenges for that southern African country, as highly qualified personnel are required to maintain, conduct research and also run quality assurance tests on LINACs. In addition, a recently acquired Magnetic Resonance Imaging (MRI) camera would require a sound human resources support from local physics institutions.

Aim: The aim of this project is together with US researchers campaign for acquisition of a miniature accelerator for educational purposes to be installed in Mozambique. Such an accelerator will be installed at the Center for Detector and Accelerator Technology (to be established) and would function as a magnet to attract young scientists interested in basic research in elementary, nuclear, medical physics and associated areas.

In addition to the accelerator/reactor, relevant ancillary electronic equipment including integrated circuits (IC), Oscilloscopes, Arduinos, Raspberry Pi, FPGA boards, soldering stations, etc. would further strengthen and widen the capabilities of the Center.

We believe that the center would be a suitable platform for young scientists to learn about and get networked with scientists in major physics experiments like CERN, PANDA, SKA and in other activities underway on the African continent.

An overall result would be contribution to knowledge, augmented awareness on the importance of Physics and Engineering in the development of society. Women, who are very disadvantaged in many low-income nations and are less likely to pursue science or engineering careers, would play a critical role in this project.

References

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